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THE MANITOU EXPERIMENTAL FOREST... Its work and aims

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U.S. DEPARTMENT OF AGRICULTURE

ESTABLISHED 1936

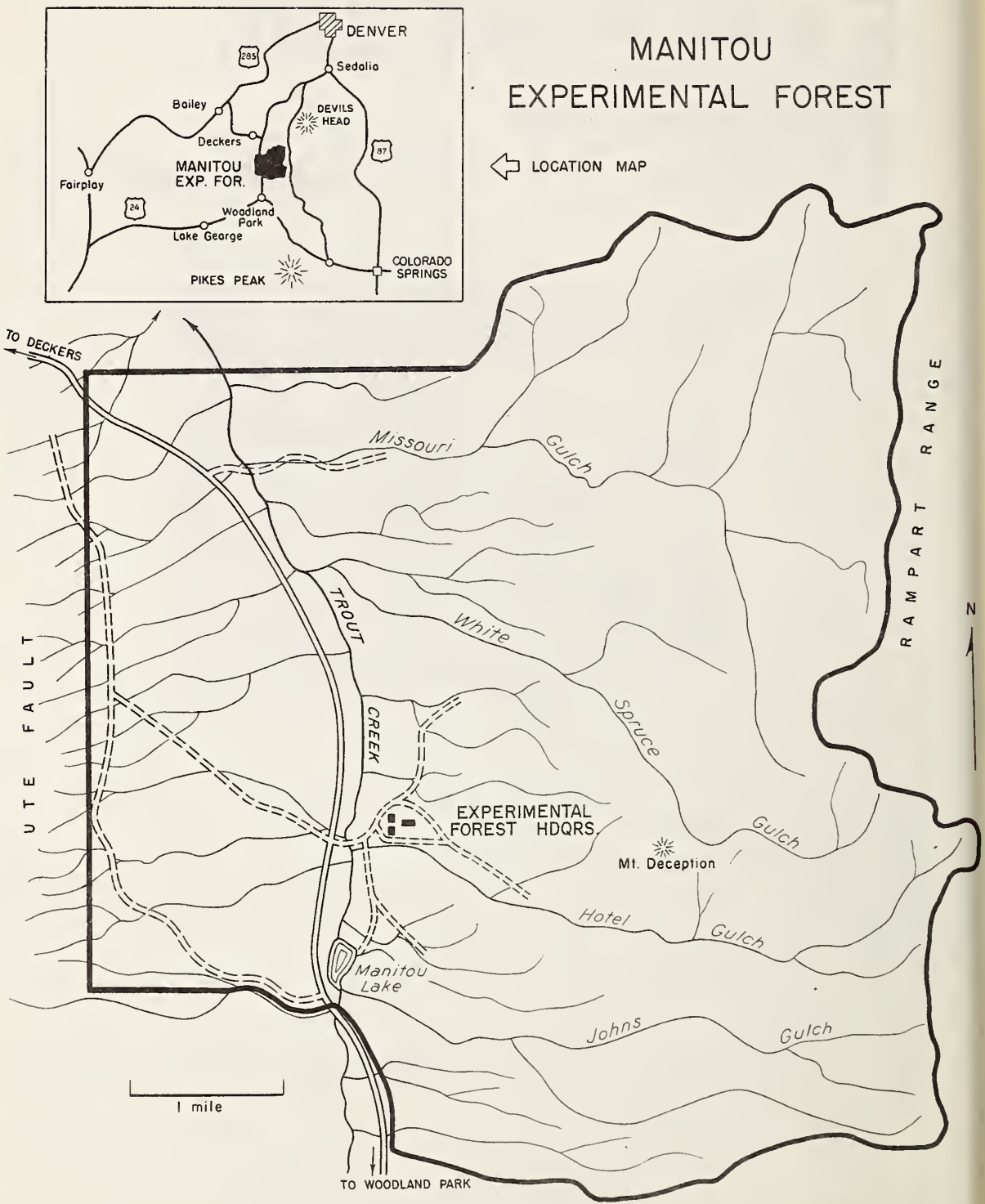
U.S. Department of Agriculture
Forest Service

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT COLLINS, COLORADO

W. G. McGINNIES, DIRECTOR

LOCATION

The Manitou Experimental Forest lies 28 miles northwest of Colorado Springs. The experimental area totals 25 square miles, and represents the land of the Front Range. Its general features are shown in the map below.



PURPOSES

The Manitou Experimental Forest was established in 1936 to study problems of land use as they relate to the management of all the resources of the Front Range. Of economic importance are water supply, recreation, livestock grazing, farming, and timber production. The objective of research work on the Forest is to develop better methods of management to perpetuate or restore the natural resources for long-time productivity. Studies are divided into (1) Range Management, (2) Artificial Revegetation, and (3) Watershed Management.

IMPORTANCE OF PROBLEMS STUDIED

Water supply is the most important subject of research at the Experimental Forest. Water yield from the forested watersheds amounts to 10 to 20 percent of the annual precipitation, or about 1/4 acre-foot per acre. Water is most usable if it is clear, thus the yield of sediment must be considered along with water.

Livestock grazing is another important land use. The parts of the Forest that are suitable for grazing produce forage for beef. Heavy grazing reduces the vegetation cover and bares the soil for accelerated runoff and erosion, which in turn clogs stream channels and reservoirs with sediment.

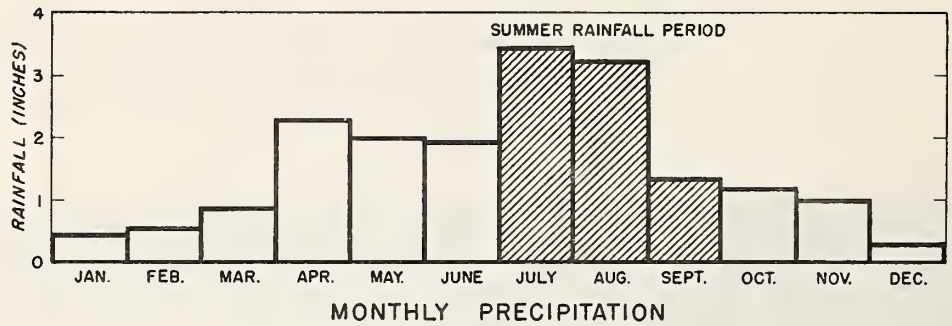
Recreation, timber production, and farming are less important on the Forest. Elsewhere in the Front Range these uses of land furnish a living for many local residents.

Trout Creek with Pikes Peak in background
Manitou Experimental Forest

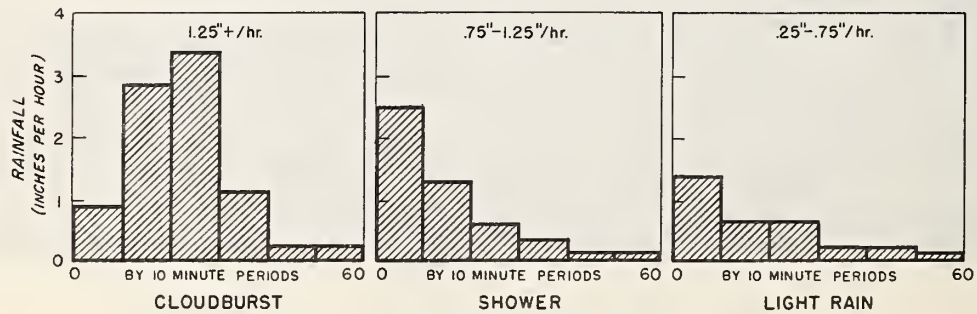
Because various kinds of land use are studied on the Experimental Forest, coordination of effort is important. Under the direction of the Rocky Mountain Forest and Range Experiment Station at Fort Collins, Colorado, resident technicians undertake research work in range and watershed management. Several college students in forestry are selected each year as summer assistants. Nearby residents are cooperators in many of the research studies. Every other year a field day is held as an "Open House," with a special opportunity for public discussion of the research program.

CLIMATE

The climate is mild, with an average yearly temperature of about 45 degrees. The mean monthly temperature for January is 27 degrees; for July, 60 degrees. On the average there are 113 days in the growing season, the frost-free period extending from May 28 to September 18. Annual precipitation averages about 17 inches; of this, 58 percent occurs during the growing season. Yearly precipitation has varied from 8 inches to 26 inches.



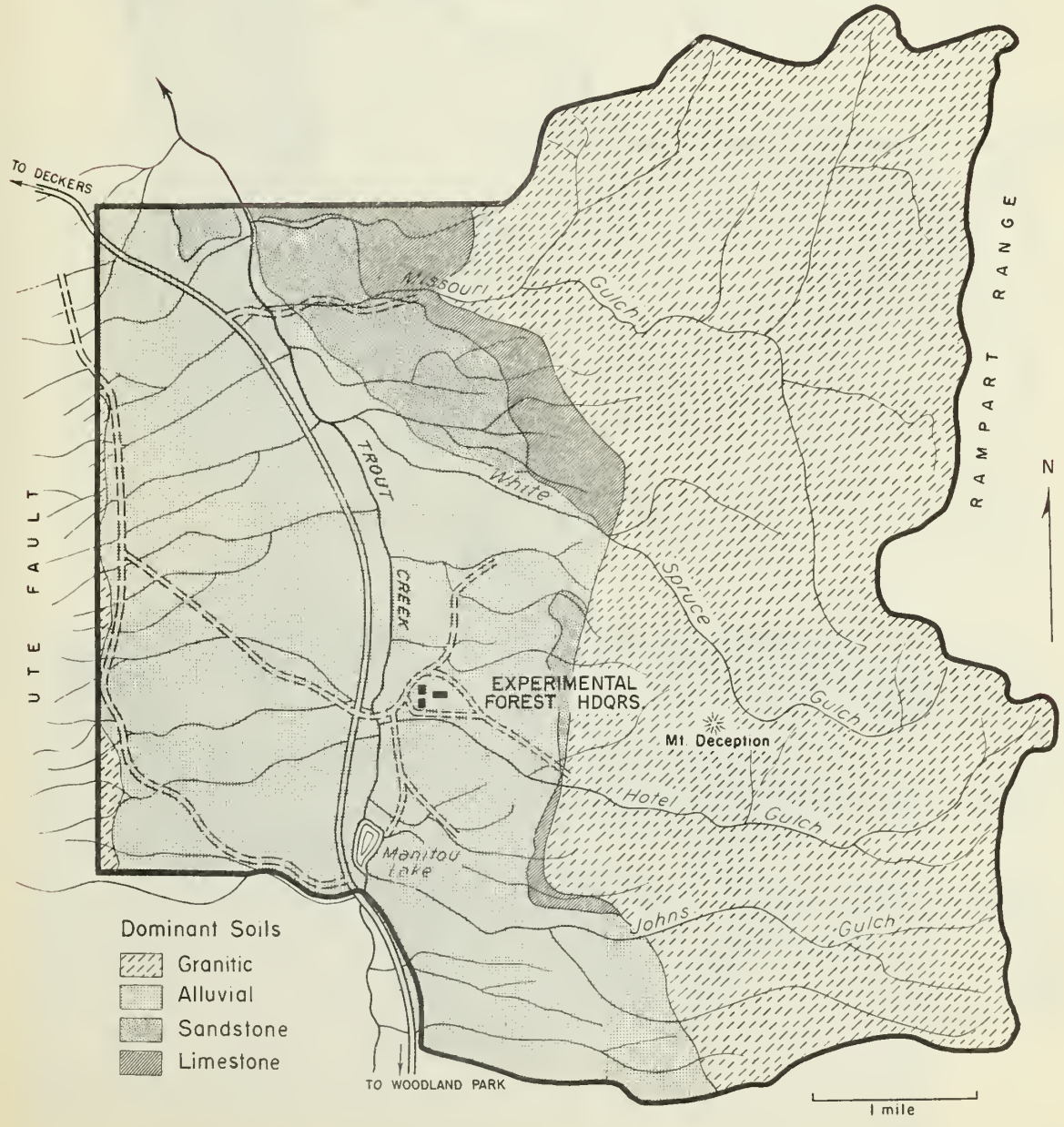
MONTHLY PRECIPITATION



TYPES OF SUMMER STORMS
(Records overoged)

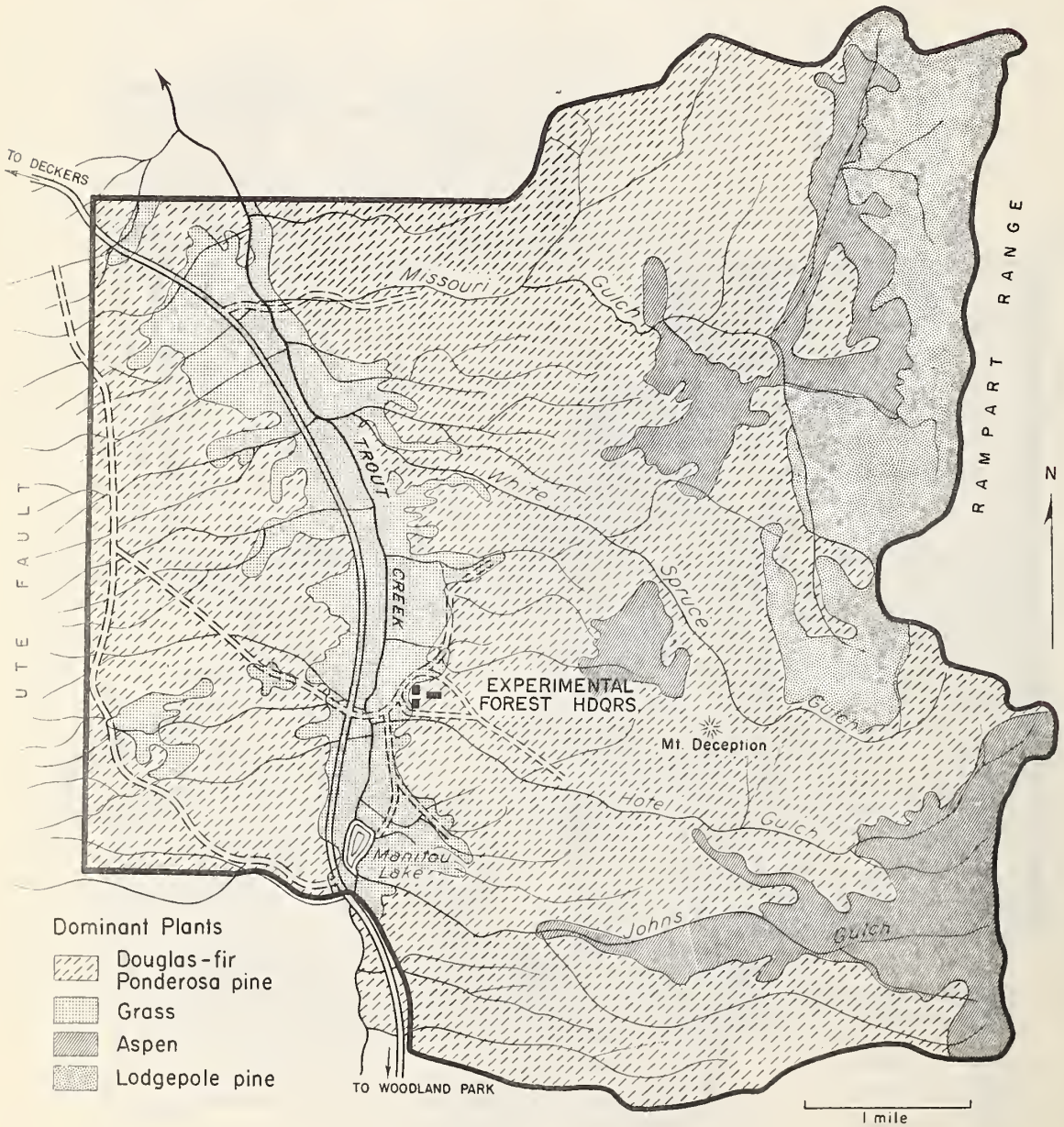
The Experimental Forest includes broad, gently rolling valleys and plateaus, and rugged mountains with narrow, steep-walled canyons. The elevation ranges from 7,500 to 9,500 feet. Granitic soils of low fertility and high erodibility occur in the rough eastern part. Alluvial soils formed by stream outwash are of medium fertility and occupy the level portions. Limestone soils, which are the most productive, and sandstone soils also are found in small areas of the Forest.

Examples of geologic and accelerated erosion are found throughout the Forest. The general distribution of the soils is shown below.



The native vegetation is typical of ponderosa pine forests in the southern Rocky Mountains. Ponderosa pine, Douglas fir, lodgepole pine, and aspen are the important tree species. Bunchgrasses make up most of the grass vegetation. The most common are Arizona fescue and mountain muhly. Shrubs may be seen occasionally throughout the timbered areas.

The Experimental Forest has been grazed by livestock and logged. Below is a map showing the general distribution of the native vegetation.

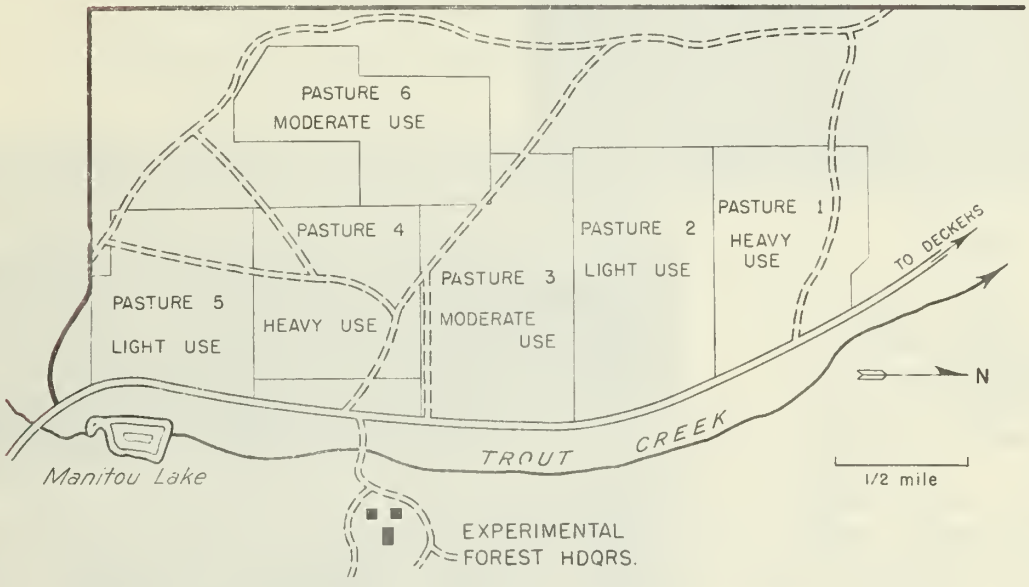


PASTURE STUDIES

Since 1942 yearling Hereford heifers furnished by local ranchers have been grazed for a 5-month season, June 1 to October 31, on six pastures of about 300 acres each. Three rates of stocking representing heavy, moderate, and light use of the vegetation have been studied. The stocking rates of the pastures are:

Heavy	-	57 percent of annual herbage removed
Moderate	-	33 percent of annual herbage removed
Light	-	14 percent of annual herbage removed

EXPERIMENTAL PASTURES



PRIMARY OBJECTIVES

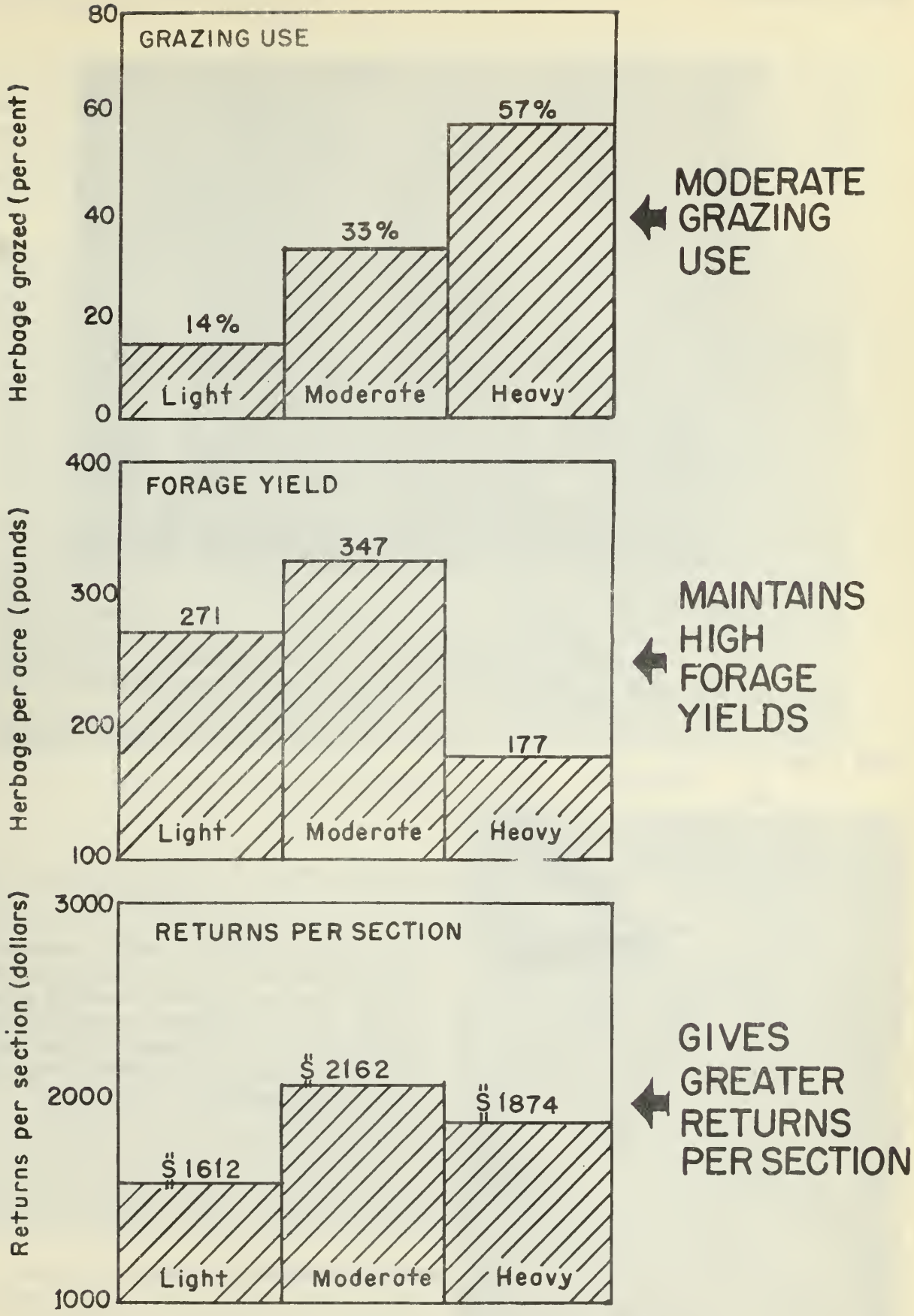
Good cattle
Good range
Good watersheds

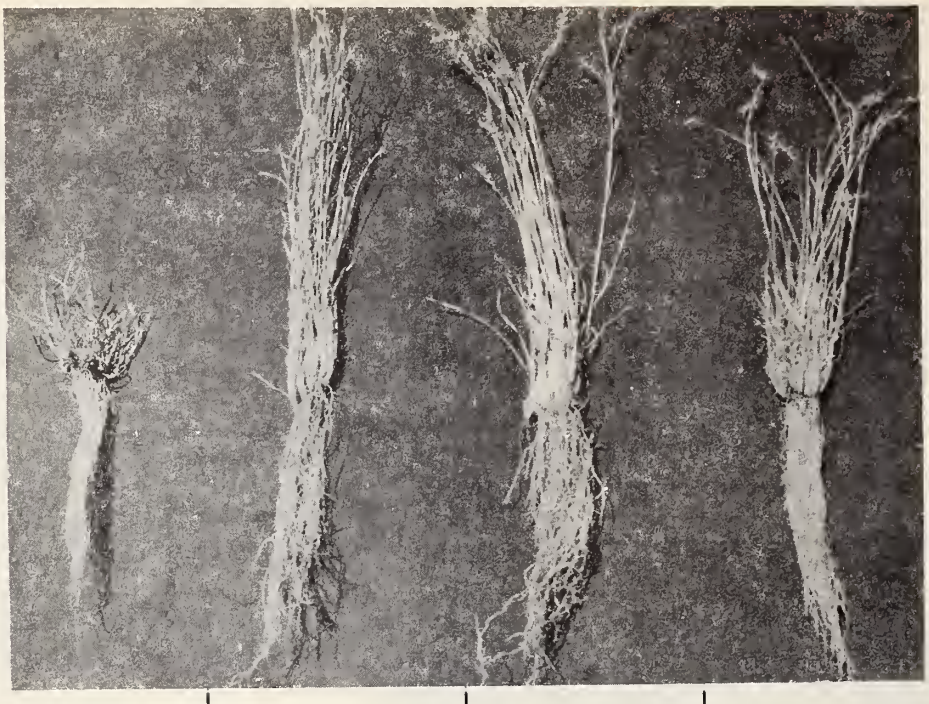
Best economy
for all
in the long run

Stocking rate based on 57% herbage removed. Heavy grazing reduces annual forage production, depletes the grass stand, gives poor cattle gains, and a gross return of $1,874 per section

Stocking rate based on 33% herbage removed. Moderate grazing maintains annual forage production, improves the grass stand, gives good cattle gains, and a gross return of $2,162 per section

Stocking rate based on 14% herbage removed. Light grazing improves annual forage production, increases the grass stand, gives high cattle gains and a gross return of $1,612 per section


GRAZING USE
Herbage grazed (per cent)
80
60
40
20
0
14%
33%
57%
Light
Moderate
Heavy
MODERATE GRAZING USE
FORAGE YIELD
Herbage per acre (pounds)
400
300
200
100
271
347
177
Light
Moderate
Heavy
MAINTAINS HIGH FORAGE YIELDS
RETURNS PER SECTION
Returns per section (dollars)
3000
2000
1000
$ 1612
$ 2162
$ 1874
Light
Moderate
Heavy
GIVES GREATER RETURNS PER SECTION



Heavy use | Moderate use | Light use | No use

Both root and top growth of little bluestem (Andropogon scoparius) are reduced by heavy grazing use

Blue grama ↓

Not only is herbage yield reduced by heavy grazing, but also less desirable forage species invade heavily grazed areas. Here blue grama, a low-yielding grass in mountain areas, is replacing mountain muhly, a high-producing, palatable bunchgrass.

← Mountain muhly

In addition to learning how to manage native pastures it is also necessary to learn how to heal the scars of past abuse. Methods of artificial revegetation of abandoned farm lands and depleted range lands are tested. The objectives are to (1) increase forage production, and (2) stabilize eroding soil. The first step is to find out what plants will grow best in the Front Range areas.

Row plots where 130 grasses, legumes, and shrubs have been tested for adaptability

A 1-year-old stand of intermediate wheatgrass seeded on depleted range land in South Park. The seedbed was prepared with a moldboard plow followed by packing and drilling.

The best species from the nursery trials are then tested in field plots at many different locations to determine which are best suited for different elevations and sites.

Small pastures of crested and intermediate wheatgrasses, Russian wild-rye, and smooth bromegrass are being grazed at heavy, moderate, and light intensities.

SMOOTH BROME

HEAVY USE

MODERATE USE

Reseeded grasses are not miracle grasses. They can be destroyed by too heavy grazing. Grazing smooth brome to a 2-inch stubble will weaken the plants' vigor and cause lower production

Livestock gains, herbage yields, and beef production show clearly the advantages of successful reseeding

Reseeded pasture	Herbage yield	Heifer days grazing	Gain per day	Total gain
	Lbs./acre	Per acre	Lbs.	Lbs./acre
Smooth brome	1,399 (4 yrs.)	42 (3 yrs.)	1.5 (3 yrs.)	65 (3 yrs.)
Crested wheatgrass	1,959 (4 yrs.)	44 (3 yrs.)	1.6 (3 yrs.)	77 (3 yrs.)
Intermediate wheatgrass	1,668 (2 yrs.)	47 (1 yr.)	1.7 (1 yr.)	84 (1 yr.)
Mixture: crested wheatgrass, smooth brome, sweet clover	2,471 (4 yrs.)	47 (3 yrs.)	1.7 (3 yrs.)	91 (3 yrs.)
Russian wild-rye	409 (1 yr.)	Grazed for first time in 1951		

SMOOTH BROME: Widely known, widely used. Good spring and summer pasture. Not as productive as other grasses. Prefers moist ground.

CRESTED WHEATGRASS: Also widely known and used. Excellent spring pasture and hay crop. High production, more resistant to grazing than smooth brome.

INTERMEDIATE WHEATGRASS: A newer importation from the old world. Excellent spring and summer pasture, good hay crop, and high seed production.

RUSSIAN WILD-RYE: Another newer importation. Low producer, but excellent early spring pasture. Ready for grazing 2 to 3 weeks earlier than crested wheatgrass.

BLUEBUNCH WHEATGRASS: Native to United States. Slower and more difficult to establish than other grasses, but makes excellent summer pasture.

BIG BLUEGRASS: Native to United States. Excellent late - fall, early winter pasture. Has had 8 to 10 inches green growth at the Experimental Forest in late December.

STREAM FLOW

Since 1939 stream flow, precipitation, and ground water records have been taken in the 4,800-acre Missouri Gulch watershed. These records provide knowledge of various storm patterns occurring on the watershed and their influence on stream flow and erosion. The watershed is grazed by livestock.

PLANT COVER

Records of precipitation, runoff, and erosion have been kept since 1939 on six small ponderosa pine watersheds of 1 to 2 acres in size. Recently, two watersheds have been cut and burned to encourage the growth of aspen and two to develop a grass stand, while two were left unchanged. These watershed studies will give clues as to which type of vegetative cover is superior in managing a watershed.

SEDIMENTATION

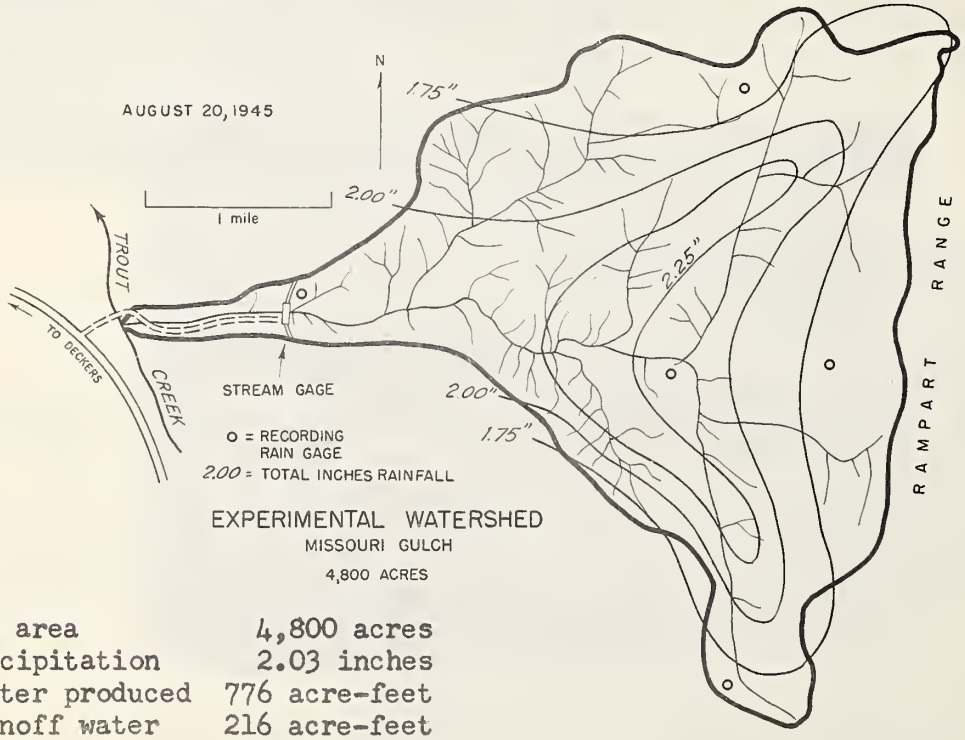
Gully erosion and bank sloughing yield the greatest amount of sediment to stream channels. A sedimentation study has been made of Manitou Lake. Gully and sheet erosion studies have been made on the experimental pastures. Erosion and sediment-yield characteristics of the soils have been determined.

Sediment bars in the South Platte River move downstream at the rate of 1½ miles per year and are erosion depositions from steep slopes, gullies, and roads.

Missouri Gulch stream gage during high spring flow

A MISSOURI GULCH STORM

High runoff from cloudburst storms is related to storm distribution, total precipitation, and stream flow at the time of the storm (antecedent flow). High antecedent flow indicates a low watershed capacity to store additional rain water. Storage capacity is influenced by vegetation which promotes water absorption.

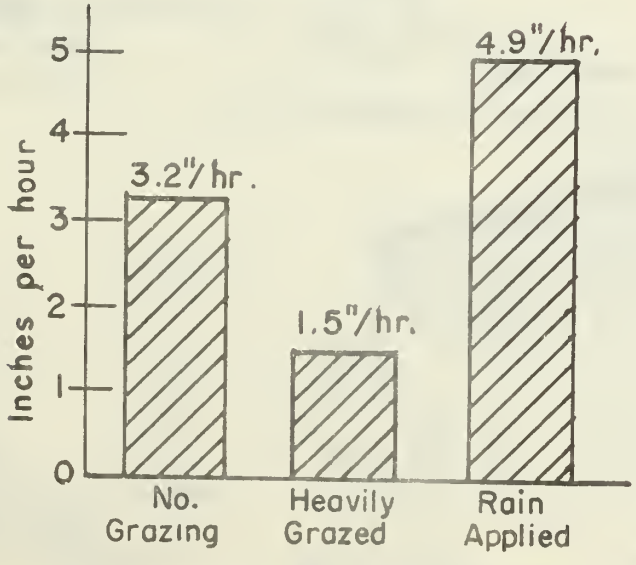


NOTES

Watershed area	4,800 acres
Total precipitation	2.03 inches
Volume water produced	776 acre-feet
Volume runoff water	216 acre-feet
Runoff	28 percent
Peak flow	107 c.f.s.
Daily antecedent flow	16 acre-feet

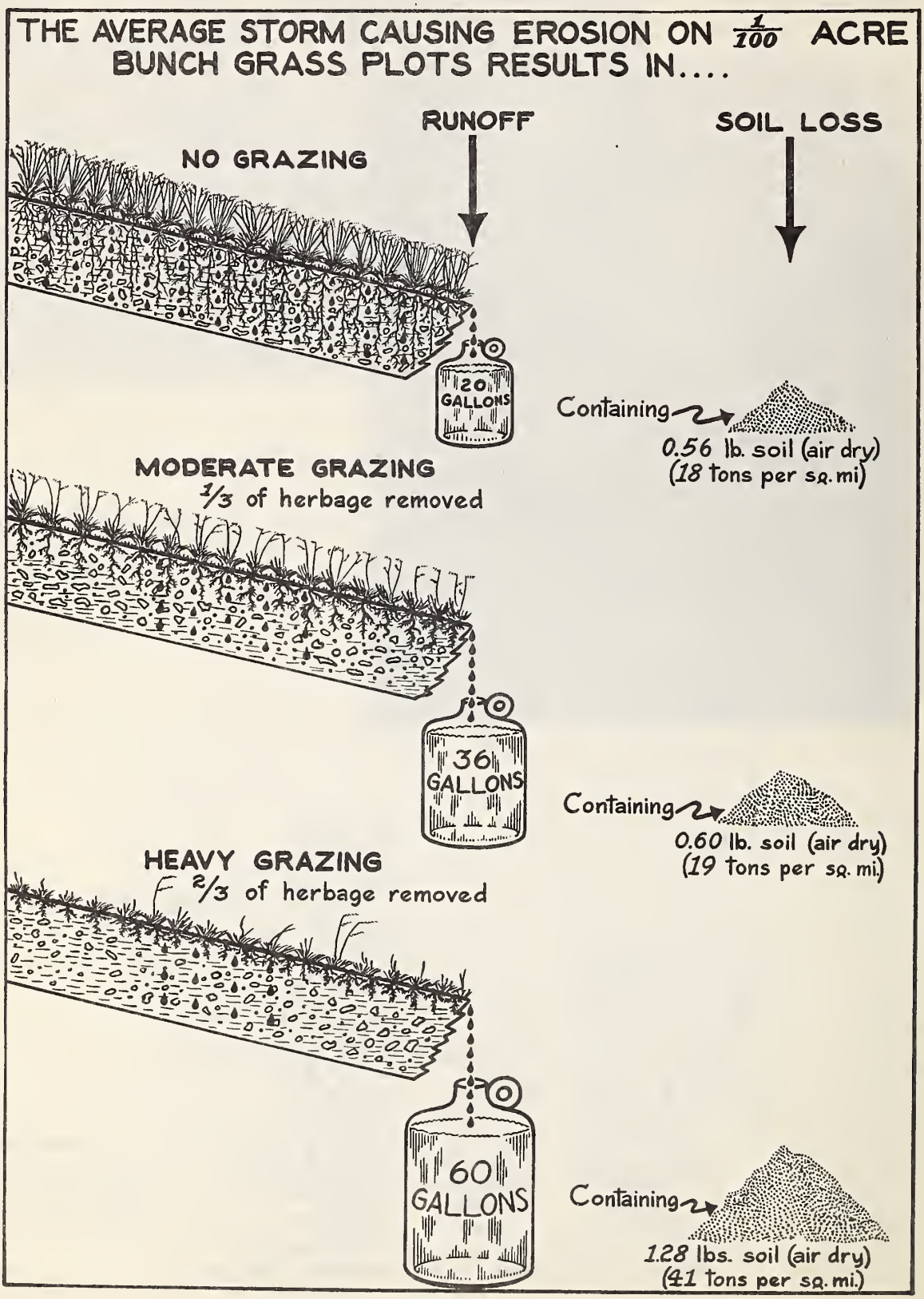
Grazing changes the water-absorbing capacity of the soil. Tests by applying artificial rainfall to small plots scattered in the six pastures have established this fact. The rates of water absorption decrease as grazing becomes heavier.

Rocky Mountain infiltrometer used to apply rain to small plots to obtain indices of water absorption, runoff and erosion under different conditions of vegetation, soil, and use.



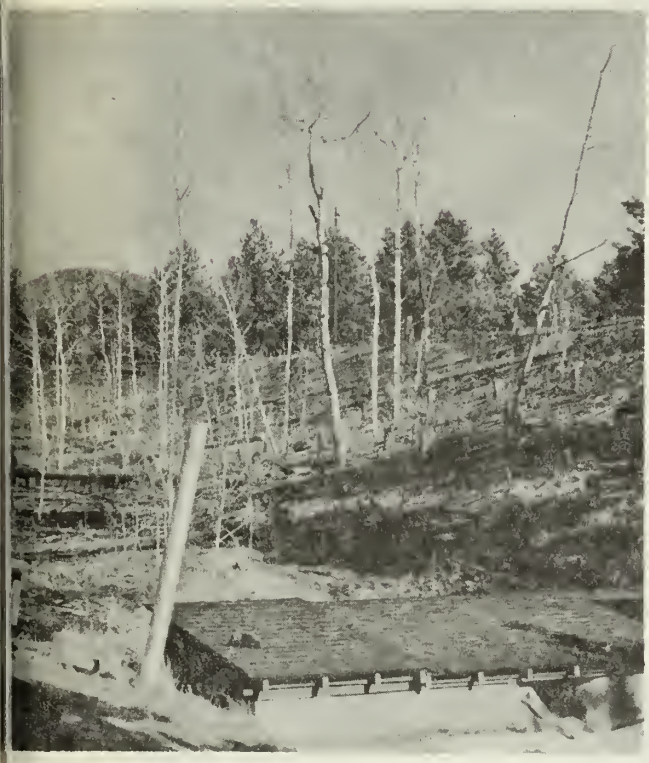
Heavy grazing decreases water absorption.

Too heavy grazing reduced water absorption. Decreased absorption of rainfall increases runoff and erosion. Since 1939 grazing effects on runoff and erosion have been studied on six plots of 1/100 acre each. Two of these have been grazed heavily, two moderately, and two ungrazed. Runoff and erosion are measured from the individual plots after each natural storm.



LOGGING AND BURNING
A
SMALL PONDEROSA PINE WATERSHED

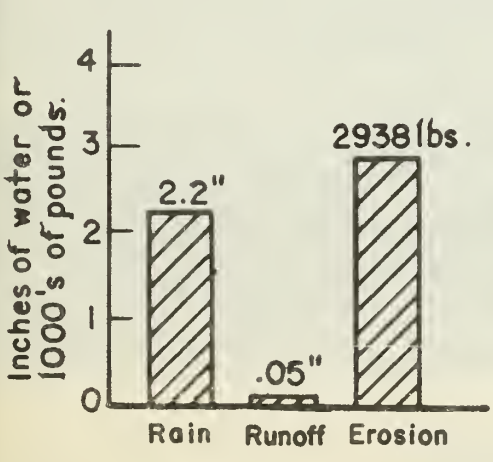
CONVERTED TO ASPEN



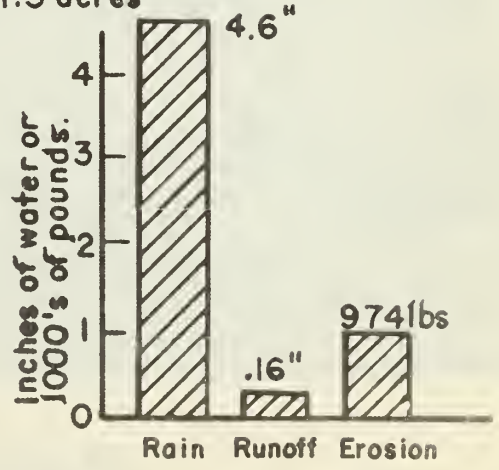
ORIGINAL CONDITION

RUNOFF and EROSION

Watershed A - 1.5 acres



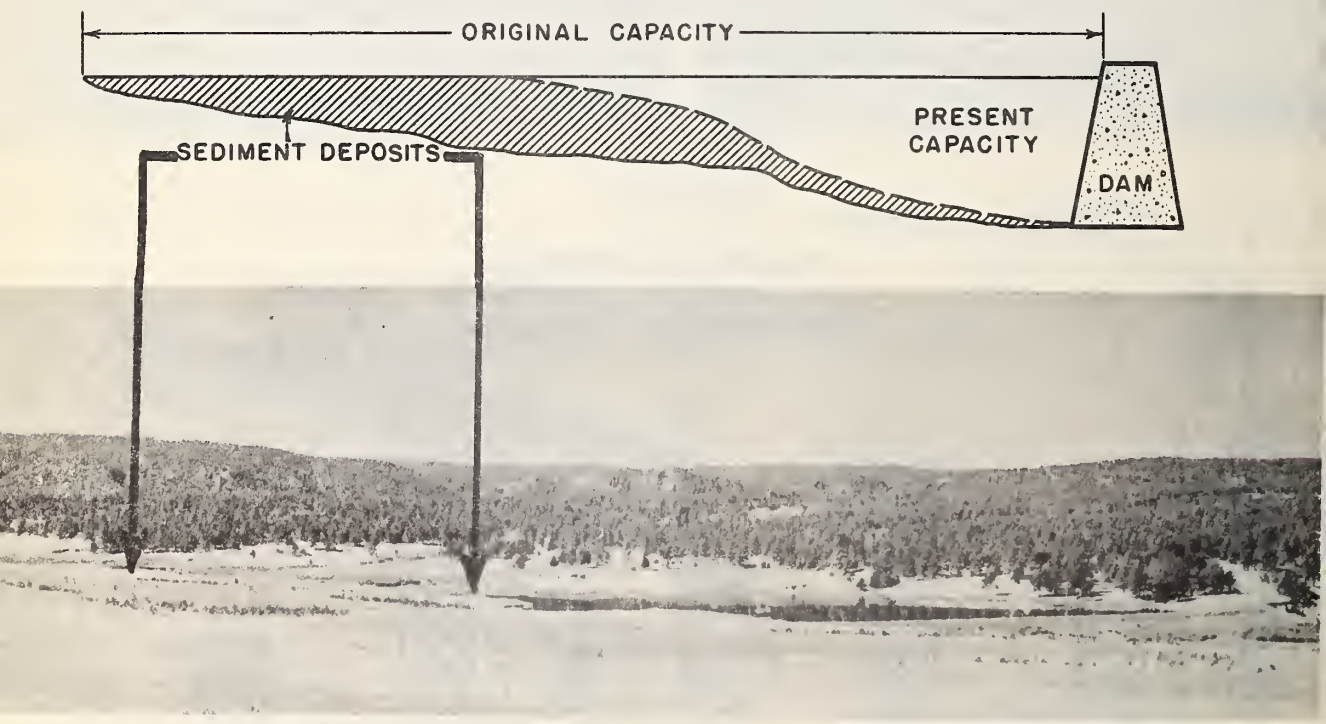
Total of four storms - 1949



Total of four storms - 1945

Gully erosion accounts for 60 percent of sediment in stream channels and reservoirs

SEDIMENT REDUCES STORAGE CAPACITY



Manitou Lake Reservoir

Each year, from 400 to 500 people visit the Manitou Experimental Forest. For many of these visitors, it means seeing field research work for the first time. They often learn about practices which apply directly to their home conditions.

Many hundreds of campers spend from a day to several weeks at the public picnic and camp ground beside Manitou Lake. The State Game and Fish Department stocks the lake annually with legal-size trout. Week-end summer visitors from nearby towns make the lake and its camp ground their headquarters.

During the fall months, the Forest is used for deer hunting. Roads and trails make the area reasonably accessible for hunters.

The eastern part of the Forest is bounded by the Rampart Range road. It provides a scenic motor trip. The many lookout points and picnic grounds give a panoramic view of the plains and valleys to the east.

Manitou Lake
Pikes Peak in background

1. Visitors are always welcome. To obtain more detailed published information about the experimental work, ask the resident technicians, or a letter may be addressed to the Director, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

2. Research at the Manitou Experimental Forest is coordinated to provide knowledge about the many interrelated uses of forest lands. This is necessary in order to serve the greatest number of people in the long run. Research deals with the effect of use on renewable resources and therefore necessarily requires a long time to accomplish.

3. The economy of the area surrounding the Forest is one of mountain agriculture. Through the occupancy, development, and use of the land by people, various problems of land use, water rights, land ownership, and tenure leases arise. No problem is static where full use of the resources is yet to be realized. Sedimentation of stream channels and reservoirs has now become critical. Studies of the conditions affecting sedimentation will receive more emphasis in the future. To what extent native vegetation can aid in its practical control is an important question. Likewise, emphasis will be placed on upstream flood control. Damaging flood flows in streams start with severe storms in the upstream areas.

4. Opportunities are unlimited for graduate students to undertake fundamental research in the conservation of natural resources. Arrangements may be made through colleges, universities, foundations, or other interested groups and the U. S. Forest Service on a cooperative basis.

5. The facilities of the Manitou Experimental Forest are used from time to time for training schools, for undergraduate field work, and for field meetings of agricultural and conservation societies. Excellent examples, nearby and on the Forest, serve as on-the-ground illustrations of both beneficial and harmful practices in mountain agriculture.

FARMS AND CITIES OF COLORADO DEPEND

ON

FRONT RANGE WATERSHEDS

From the forested watersheds comes the water for homes, cities, industries, and farms. Water is a first necessity of western life and livelihood. To be fully useful, its flow should be controlled naturally and it should be mud free.

CONSERVATION THROUGH RESEARCH

The Manitou Experimental Forest is a research unit of the Rocky Mountain Forest and Range Experiment Station, which is maintained in cooperation with the Colorado A & M College at Fort Collins, Colorado

Prepared by: L. D. Love, Forester, and
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